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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/500,938	07/08/2004	Gary W. Elko	1053.001B	1487

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EXAMINER	
LEE, PING	

ART UNIT	PAPER NUMBER
2615	

MAIL DATE	DELIVERY MODE
10/03/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/500,938	ELKO ET AL.	
	Examiner	Art Unit	
	Ping Lee	2615	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05 May 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-84* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5,12-25,31-35,42-46,51-56,63-71 and 76-84* is/are rejected.

7)☒ Claim(s) *6-11,26-30,36-41,47-50,57-62 and 72-75* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. Applicant proposed to incorporate the limitation of claims 14 and 79 into claim 1 on a telephone interview conducted on 5/27/08. After conducting search, examiner discovered a new reference written by Nelson et al. The new ground of rejection is provided below in addition to the old ground of rejection is provided below.

Claim Rejections - 35 USC § 102

2. Claims 1-3, 12, 13-19, 23-25, 31-33, 42, 43-46, 51-56, 65, 66, 69, 71 and 76 are rejected under 35 U.S.C. 102(b) as being anticipated by Elko (US006041127A).

Regarding claims 1, 3, 24, 31-33 and 45, Elko discloses a method for processing audio signals, comprising:

receiving a plurality of audio signals, each audio signal having been generated by different sensor of a microphone array (see Fig. 22); and

decomposing the plurality of audio signals into a plurality of eigenbeam outputs, wherein each eigenbeam output corresponds to a different eigenbeam for the microphone array and at least one of the eigenbeams has an order of two or greater (see Fig. 24; col. 17, lines 26-33).

Regarding claims 2, 12, 13, 42 and 43, Elko discloses the signal analysis using spherical coordinates, so Elko show spheroidal harmonics based on a spherical configuration. By using spherical coordinates, the number and positions of sensors in the microphone array enable representation of a beampattern as a series expansion

involving at least second-order spheroidal harmonics. See the analysis from col. 12, line 15+.

Regarding claims 4, 5, 34, 35 and 54-56, Elko shows the acoustically rigid sphere (col. 14, lines 15-16 and abstract).

Regarding claims 14, 44 and 65, the claimed discrete orthogonality condition reads on the condition as shown in Fig. 22 with discrete microphones, microphone 222 is being 90° from microphone 224.

Regarding claims 15 and 66, Elko shows treating each sensor signal as a directional beam for relatively high frequency components in the audio signal (col. 6, lines 32-38).

Regarding claims 16, 17, 46, 51, 52, 71 and 76, the claimed auditory scene read on each steered direction formed by the microphone array. Elko shows that two or more different auditory scenes could be generated (col. 17, lines 18-20).

Regarding claims 18 and 52, Elko shows the weighting (see equation 31).

Regarding claim 19, Elko shows that DSP is being used for processing; therefore, it inherently stores and recovers data for subsequent processing.

Regarding claim 25, Elko shows the calibration (col. 17, lines 4-5).

Regarding claims 23 and 53, Elko shows he equalizer filter (2443).

Regarding claim 69, due to steering, Elko's system would discriminate noise and inherently maintain a minimum value of signal-to-noise ratio.

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 1-3, 12-24, 31-33, 42-46, 51-53, 63-71 and 76-78 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moorer (US006904152B1).

Regarding claims 1, 3, 14, 24, 31-33 and 44, Moorer discloses a method for processing audio signals, comprising:

receiving a plurality of audio signals, each audio signal having been generated by a different sensor of a microphone array (for generating mono sources 17 and 19); and

decomposing the plurality of audio signals into a plurality of eigenbeam outputs (the end of col. 5), wherein each eigenbeam output corresponds to a different eigenbeam for the microphone array.

For a specific example, Moore teaches the only the zero and first order of harmonics are required (col. 5-6), but fails to show at least one of eigenbeams has an order of two, or three or greater. However, in view Moore as a whole, one skilled in the art would derive at least the second order of harmonics together with the zero and first order of harmonics if more speakers are used for generating the output signals (col. 5, lines 29-32; and col. 11, lines 61-63). Thus, with Moore in front of him/her at the time of the invention was made, one skilled in the art would have been motivated to generate an eigenbeam having an order of three or greater if seven ore more speakers are being used to recreate the sound field.

Regarding claims 2, 12, 13, 42, 43, 63 and 64, as shown in Fig. 10 of Moorer, the eigenbeams correspond to spheroidal harmonics based on a spherical configuration of the sensors in the microphone array.

Regarding claims 15 and 66, Moorer shows the step of treating each sensor signal as a direction beam for a relatively high frequency components in the audio signals (each beam is defined based on the spherical coordinates; col. 7, lines 28-50).

Regarding claims 16-18, 46, 51, 52, 65 and 71, the claimed auditory scene reads on the audio signal reproduced by a speaker. See Fig. 4 as an example on how to generate the auditory scene by applying a weighting value to each eigenbeam output.

Regarding claims 19-22, 45, 67 and 68, with the digital signal processing (col. 11, lines 35-42), the data is inherently stored for subsequent processing, or it reads on the claimed recording medium.

Regarding claims 23 and 53, Moorer shows the equalizer filter (col. 7, lines 28-50).

Regarding claim 69, due to steering, Moorer's system would discriminate noise and inherently maintain a minimum value of signal-to-noise ratio.

Regarding claim 70, although Moorer fails to show that the SNR is characterized using white noise gain. Examiner takes Official Notice that this feature is notoriously well known in the art. Thus, it would have been obvious to one ordinary skill in the art to modify Moorer by using well known method for calculating SNR based on white noise gain.

Regarding claims 76-78, Moorer discloses that the generation of the auditory scene is by receiving the specified direction for the directional beam (defined by the actual speaker location in terms of spherical coordinates; col. 16, lines 1-9).

5. Claims 4, 5, 25, 34, 35 and 54-56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moorer (US006904152B1) as applied to claim 1 above, and further in view of Elko (US006041127A).

Regarding claims 4, 5, 34, 35 and 54-56, Moorer fails to show the microphones being mounted on an acoustically rigid sphere. In the same field of endeavor, Elko teaches a practical microphone array assembly using a rigid sphere made of Nylon (col. 16, lines 1-13). Thus, it would have been obvious to one of ordinary skill in the art to modify Moorer in view of Elko by using the rigid sphere made of Nylon for mounting the microphones in order to provide a three-dimensional sound detector with an excellent response exceeding 5 kHz.

Regarding claim 25, Moorer fails to show the step of calibrating each sensor of the microphone array based on measured data generated by the sensor. Elko teaches that it would be advantageous to closely calibrate the microphones with each other for the microphone array to behave as a true gradient microphone (col. 17, lines 1-17). Thus, it would have been obvious to one of ordinary skill in the art to modify Moorer in view of Elko by calibrating the microphones in order to provide a microphone array as a gradient microphone.

6. Claims 79-84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Moorer as applied to claims 1, 14, 31, 44, 51 and 65 above, and further in view of

Nelson et al (hereafter Nelson) ("Spherical Harmonics, Singular-Value Decomposition and the Head-Related Transfer Function").

Regarding claims 79-84, Moorer fails to disclose the claimed equation to define the discrete orthogonality condition. Moorer teaches how to use spherical harmonic to decompose the sound received at the microphone to be recreate later by the speakers. Nelson also teaches to use spherical harmonic to decompose a radiated wave. The discrete orthogonality condition is being used to find the coefficients in the expansion (see sect. 2.4 and equation 47). Although Nelson's teaching is applied to the radiated wave, instead of the received wave, based on the nature of the radiated sound wave and the received wave, one skilled in the art would have expected that the same analysis taught in Nelson could be applied to for analyzing signal received at a microphone without generating any unexpected result. Thus, it would have been obvious to one of ordinary skill in the art to modify Moorer in view of Nelson by utilizing the discrete orthogonality condition for the signal analysis in order to find the coefficients for the harmonics.

Equation 47 in Nelson uses mathematical operator "$|\ \ |^2$" after the summation. By expanding the term defined by the operator "$|\ \ |^2$", it reads on the claimed equation.

Response to Arguments

7. Applicant's arguments filed 5/5/08 have been fully considered but they are not persuasive.

Applicant argued that Elko fails to generate second-order or higher harmonics on p. 15, examiner disagreed. First of all, claim 1 does not specify "second-order or higher harmonics". The claimed limitation called for at least one eigenbeams has an order to two or greater. The claimed eigenbeam is being interpreted as a beam representing a transformation. The embodiment as shown in Fig. 22 is a microphone array placing on a three-dimensional sphere. As illustrated in Fig. 24, each eigenbeam is generated based on three different pairs of microphones representing the X-pair, Y-pair and Z-pair respectively located at the position defined by φ and χ. Therefore, Elko discloses the claimed limitation of claim 1.

Applicant argued that Elko fails to show that the arrangement of the sensors in the microphone array satisfies a discrete orthogonality condition. This is not persuasive. Fig. 22 of Elko shows that the microphones satisfy a discrete orthogonality condition. This meets the claimed limitation. Furthermore, applicant seems to define the limitation of "an eigenbeam of order two or greater" based on the disclosure in the specification. Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant's arguments with respect to claims 1, 12-14, 31, 42-46, 51-53, 67, 68 and 71 in view of 102 (b) rejection by Moorer '878 have been considered but are moot in view of the new 103 rejection. Although a different patent issued to Moorer ('152) has been used for rejection, the basic principle in both Moorer references is the same. They both provide motivation and suggestion to decompose microphone signals using higher

harmonics if more speakers are used for reproducing and recreating the audio scene. Moorer '152 explicitly shows the spherical configuration of the sensors in the microphone array as recited in claim 2.

Allowable Subject Matter

8. Claims 6-11, 26-30, 36-41, 47-50, 57-62 and 72-75 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ping Lee whose telephone number is 571-272-7522. The examiner can normally be reached on Monday, Wednesday and Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vivian C. Chin can be reached on 571-272-7848. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Ping Lee/
Primary Examiner, Art Unit 2615

pwl